TRAFFIC ENGINEERING

Vol. XI JUNE, 1940 No. 2

TRAFFIC SIGNAL COLOR SEQUENCE

by WILLIAM C. BRANDES, *Traffic Signal Engineer, Chicago, Illinois*

WHAT are the most logical and proper interpretations of color indications in traffic signals? That is a question to which the traffic engineering profession might produce an answer to the end that all confusion be eliminated. The entire public certainly would welcome uniform practice in the use of signal colors. However, any standard of color sequence should be based on the highest possible development in point of safety, proper usage by the public, and ease of enforcement.

Discussions of color sequences such as that written by Guy Kelcey and Irving Mack and appearing in the April 1940 issue of TRAFFIC ENGINEERING, serve to create interest in the subject and initiate action aimed at an ultimate standard. Likewise the following discussion is inspired by a desire to stimulate study of the problem in all its aspects and is not submitted in defense of any prevailing practice in any locality.

Meaning and Use of Colors

We should consider the use of the three colors, red, green and yellow from the earlier installations down to the present day. These colors with their meanings were adopted from the more or less standard railroad practice. Green in a traffic signal meant "Go" while red designated "Stop." Yellow, a color of caution in railroad circles, was assigned in traffic control to warn of an impending change of direction of movement as from north and south to east and west. If we bear in mind this fundamental meaning ascribed to the yellow or amber color in traffic signals and then consider the many variations into which it has been warped to the present day it is small wonder that the wide travelling public is a bit confused and enforcement agencies are at sea.

A Committee of the Highway Research Board headed by W. A. Van Duzer of Washington, D. C. has been assigned to study the "sequence and overlapping of the amber indication." That Committee in its preliminary surveys has found, in a limited number of localities, a surprising number of variations in the use of amber in the traffic signal sequence and corresponding variations in meaning to the motorist.

The Pedestrian Indication

In the recent article previously referred to, it is indicated that the intermediate interval is intended to give pedestrians time to clear the intersection although it is stated that three seconds is generally the proper length of such interval because it gives vehicles moving at reasonable rates of speed sufficient time to stop or clear the intersection. How far can a pedestrian move in three seconds? Approximately 15 feet at the average gait. He is then not out of danger when his opposing vehicle stream is given the right of way. We must acknowledge the fact that to give the pedestrian adequate warning that he no longer has sufficient time to cross the roadway before a change of traffic movement occurs, such information must be given independently of the normal vehicle indications, which serve traffic units in a much higher speed range

and are wholly inadequate for the pedestrian.

The yellow signal should be retained in its original interpretation by confining its use to a strictly vehicle indication for an interval approximating three seconds, which is adequate for stopping or clearance, with a separate pedestrian indication during the time that a pedestrian can and should leave the curb. The length of notice to a pedestrian of impending change of traffic movement is dependent entirely upon the width of roadway he is to cross, or in some cases the distance from curb to safety island. In actual practice such a pedestrian indication has taken the form of a standard traffic signal lens with the letters "WALK" illuminated in white, the indication being extinguished when there is no longer time to cross before the traffic change.

The Value of the Combination Green and Yellow

As to the intermediate interval for vehicular traffic, it would seem that if the yellow fully overlaps the green signal, it would logically be interpreted by all that it is a traffic change interval; that moving vehicles are to be stopped as soon as possible but with green still showing it is permissible to enter the intersection if such a stop cannot be made in safety. This overlap sequence has certain other advantages over a non-overlapping yellow. To the strange driver, who may get his first view of the signal during this change interval, it tells that the change taking place is from green to red. He also knows that the signal is on normal stop and go operation and not a caution regulation displaying yellow continuously. If the reader has ever had the experience of driving into a strange city and suddenly catching sight of a signal close upon him with a lone yellow lamp burning, he knows the uncertainty of his proper action; whereas if green or red is showing also he knows instantly what the subsequent indication will be.

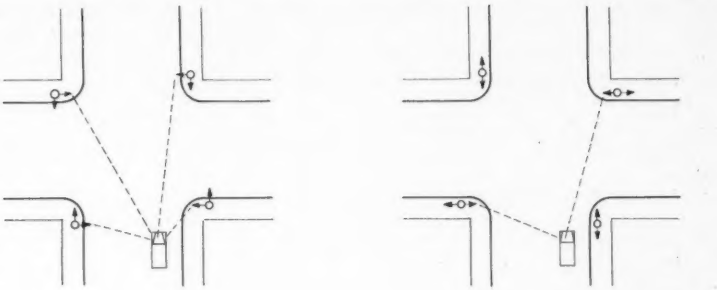
Intermediate Red

The use of "middle red" instead of yellow for the intermediate interval is obviously fundamently wrong. If this intermediate red overlaps the green the result is conflicting indications and if used alone, it eliminates any permissible clearance time causing rear end accidents and violations of an absolute stop regulation.

Advantages of the Combination Red and Yellow

With reference to the use of yellow combined with red to indicate a traffic change we are told in the article under discussion that such practice is not desirable. Before subscribing to that attitude let us go back to the original purpose of using yellow in a traffic signal, i. e., to announce an impending change of movement.

The question immediately arises, is it desirable to pre-advise standing traffic of an order to proceed? Under rural conditions where signals are distantly spaced, where approach speeds are high and enforcement personnel usually absent, strong arguments can be advanced against any yellow before green. On the other hand, in cities there is a distinct advantage in indicating an impending change to green. When great masses of vehicle units are stopped and they must get under way and pass a point in a limited space of time the highest efficiency of intersection usage must be obtained. This means movement into the intersection from one street immediately the other streets clears. Notice of impending change to green serves to overcome in some measure the effect of inertia of an immobile mass thereby stimulating movement into the first two or three seconds of the green interval. This is



FAR RIGHT (2 WAY) SIGNAL LOCATION

NEAR RIGHT (2 WAY) SIGNAL LOCATION

DOTTED LINES INDICATE EASE OF OBTAINING VIEW (IN EITHER CASE) OF YELLOW CLEARANCE SIGNAL INTENDED FOR OPPOSING STREET, WHEN YELLOW IS ELIMINATED BEFORE GREEN.

FIGURE 1

especially important where heavy traffic units are numerous.

Psychologists tell us that sudden reactions cause sudden movements. An unheralded appearance of a green signal after red frequently results in an operator performing jerky, disconcerted movements in an attempt to get under way quickly. On the other hand a notice of signal change allows a smooth positive start without nervous strain.

The Shortened Red and Yellow

Needless to say an adequate factor of safety must be introduced into the described sequence. This is done by shortening the intermediate interval of yellow and red to approximately one and one-half seconds or one-half the length of the yellow and green interval shown to moving traffic. One and one-half seconds is ample time to provide movement on the start of the green but it is too short to allow right angle collisions if it is properly observed, assuming as well that opposing traffic does not violate the clearance interval. (See Fig. 1.)

The most important advantage however in giving a short intermediate interval before the green, is that it tends to keep the eye of the vehicle operator on his proper signal. Take the yellow indication away from the driver, who is stopped on the red and he will focus his attention on the signal governing the opposing street in order to receive a full three seconds notice of a change to his green. His attention often is thereby diverted from the traffic situation directly in front. This is the practice whether the signals are located on the near or far corners of the intersection. (See Fig. 2.)

In cases of signal heads giving dissimilar indications on opposite faces and in other unusual physical layouts where for instance we may use a three phase timing scheme which is not readily apparent, as such, to the driver, it is extremely important that the operator observe his proper signal indication. Under these circumstances, the habit of taking a prior notice of change from a signal intended for traffic on another approach breeds disaster.

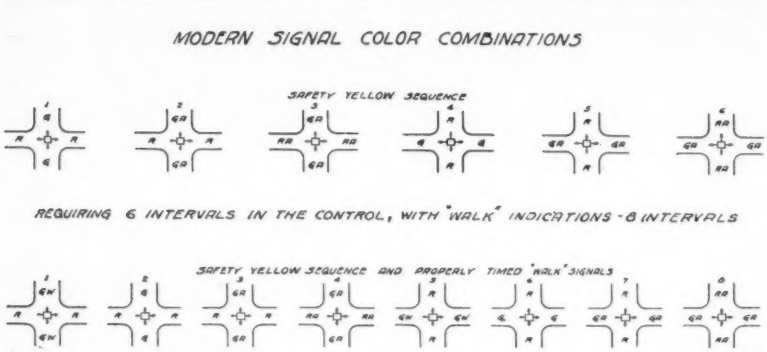

MODERN SIGNAL COLOR COMBINATIONS
SAFETY YELLOW SEQUENCE
REQUIRING 6 INTERVALS IN THE CONTROL, WITH "WALK" INDICATIONS - 8 INTERVALS
SAFETY YELLOW SEQUENCE AND PROPERLY TIMED "WALK" SIGNALS

FIGURE 2

Taking away a just indication merely because of its improper observance seems poor logic, especially so when such elimination defeats the purpose intended. In a certain jurisdiction in Chicago, an experiment was carried on which eliminated all yellow intervals before the green and also the yellow indication overlapping the green on the intersection side of the signals. In other words, a near right yellow signal showed but not a far left. Vehicle operators stopped on red would anticipate the green at the slowing down of cross traffic units. At night especially, the yellow reflection on the lens visor at the far right corner was a signal to "jump the green." That experiment proved the same fallacy as that of prohibiting Junior's access to the cookie jar by seating it high in the cupboard and neglecting the presence of the kitchen step stool. The psychology of prohibition is worthy of serious consideration.

Enforcement

The proper enforcement of a sequence as has been described need not involve difficulty, if the enforcing personnel is instructed that movement of vehicles into the intersection is prohibited while any red signal is shown. A combination green and yellow indication allows movement, with caution. If a three second green-yellow is shown, a vehicle which continues movement so as to enter the crosswalk after red appears is one which was back far enough at the appearance of yellow to have made a stop.

In cases where the intermediate interval is indicated by yellow alone, where it is naturally the question as to whether it means an instantaneous stop or a time for normal clearance. Our good friends Kelcey and Mack recognize the uncertainty of the driving public as well as enforcing officers regarding the proper meaning of such an indication. Since they also advocate the use of such a normal clearance interval, may they not see the logic of combining green with yellow to clear the ambiguity since yellow means "stop if you can safely do so" and green, "movement permissible if unable to stop."

Conclusion

If all traffic engineers were to approach the problem of signal sequence with open minds and give the subject careful study, there is no doubt that out of such concerted action would come an ultimate solution to this vexing problem. Enforcement agencies also must be considered and consulted

since the final result largely depends upon their attitude towards the practicalness of the final sequence to be adopted. Above all however, we must not lose sight of the fact that traffic signals are operated in the public interest. It is paramount that we constantly strive to improve our methods of operation for the greater benefit of all people using street and highway facilities.

PREPARING ACCIDENT SUMMARIES BY MECHANICAL TABULATION

by HARRY E. NEAL, *Chief of Bureau of Traffic and Safety*
Ohio State Highway Department

THE development and preparation of statistical summaries of traffic accident facts is an essential part of any Accident Record Bureau and in order to facilitate the preparation of these summaries, mechanical tabulation is a necessity, especially in those Bureaus where the volume of accident reports handled exceeds one thousand per month.

The Division of Traffic and Safety of the Ohio Highway Department has used mechanical tabulation of accident data for the past several years to prepare monthly statistical summaries of traffic accident facts in a minimum amount of time and with the greatest degree of accuracy.

A considerable number of other states have adopted this method of summarizing accident data; in fact, the volume of work handled by the Accident Record Bureaus of most states precludes the use of manual methods of preparing accident summaries.

One great advantage of mechanical tabulation is that special studies of accident data can be completed which otherwise would be prohibitive, if carried out manually. In addition, the tabulating card provides a permanent record of the more important data included on the original accident report form and these cards require a minimum amount of filing space.

The key to the whole system of machine tabulation is the standard punch card (7⅜ x 3¼ inches) illustrated in Fig. 1. This particular card, representing an accident reported to Ohio's Bureau during 1940, has been punched and includes practically all data available from the original accident report form.

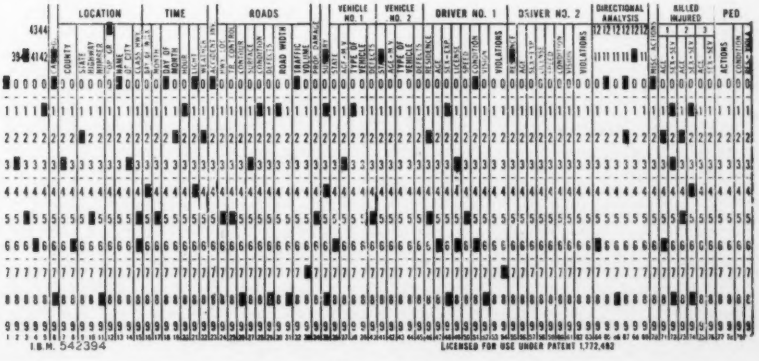


FIGURE 1

Machine tabulation requires, at the minimum, two machines—a key punch and a card counting sorter. The key punch machine perforates the cards with holes or slots as shown in the illustrated card. The card counting sorter, as the name implies, is used to count and sort the various items, represented by slots on each punch card. While not absolutely essential, a mechanical verifier has been used to great advantage by the Ohio Bureau to check and verify the punching of each card.

The mechanical tabulating system used by Ohio is similar to installations in other states and was originally designed and recommended by the National Safety Council for preparing monthly statistical summaries of accident facts.

The most satisfactory method of transferring data from the accident report form to the punch card is by the use of an intermediate coding form. This recommended method of coding and one which has been adopted by most states using the system, insures the accuracy of punch card data and speeds up the operation of punching cards. While this method inserts an additional step in the coding procedure, it is a desirable one, since the person analyzing each accident must use one of several reports for his source of information and the key punch operator can easily prepare punch cards from the intermediate coding sheet. Since the reports are numbered consecutively, the coding sheets provide a running record of the number of accidents reported.

The intermediate coding form illustrated in Fig. 2 contains several examples of typical accidents reported during 1940. As each accident is analyzed it is numbered and coded consecutively. Complete coding for most accidents extends across only one line of the coding form; if more than two vehicles are involved or more than three persons are killed or injured, another line on the coding form is used to record the necessary information. The key punch operator will then make a "trailer" card in addition to the primary card and this "trailer" card will carry the additional information. At the top of the coding form (16 x 21 inches) various headings indicate the particular data included in that part of the form as well as on the punch card. In fact, the intermediate coding form corresponds to the punch card in that vertical rulings represent columns on the punch card as perforations or slots, representing these numbers.

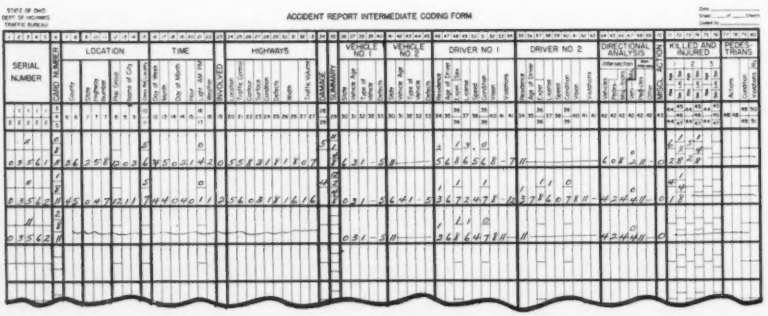


FIGURE 2

The punch card code is more or less standard and was developed by the National Safety Council for state Accident Record Bureaus. Like many other methods of record-keeping, mechanical tabulation also makes use of numerical codes. These codes are used to the greatest extent and the advantages of such a system are many.

In order to facilitate the use of numerical codes, the numerical arrangement of items on the accident report form will, in most cases, indicate the code number used to record a particular item on the punch card. For example, the schedule on type of road surface is as follows:

Type of Surface	*Code No.*
1—Concrete	1
2—Brick	2
3—Asphalt	3
4—Wood Block	4
5—Gravel	5
6—Other Type	6

Blocks are provided for the person filling out the report form to indicate, by check marks, the type of road surface at the accident location. Thus, the accident analyst can readily identify the code number used for a brick pavement without referring to a code book. Wherever possible, the numbering arrangement of items in other schedules on the report form determines the code number used for these items.

On the punch card, each hole or slot has a definite meaning and when the cards are run through a card-counting sorter, a brush makes contact with a metal roller through the opening in the card, thereby actuating the electrical counting mechanism. Tabulation of the data, however, is limited to that included in one column on the punch card. By selecting certain columns, a summary of data in those columns can be made by resorting the cards.

In some schedules, more than one column on the card is required to classify the various information. For example, county of occurrence requires two columns on the punch card and the machine operator must sort in two columns. In the first operation, the punch cards are sorted according to the first digit in the code number of Ohio counties. Since there are 88 counties, code numbers were assigned to each county depending on its alphabetical arrangement. Thus, all punch cards of accidents in counties coded as 01 to 09, inclusive, would sort in the zero pocket; cards punch 10 to 19 would sort in the one pocket, etc. A sort of each of these group of cards in the adjacent column would then identify and tabulate the accidents for each county.

Perhaps our method of locating and classifying accidents by sections of highway would be of especial interest, since summaries of this nature can be made directly from the punch cards. In Ohio, as highway mileage is added to the state system, it is permanently assigned state highway or "SH" numbers, as they are generally called. These numbers furnish the key to a numerical code which will identify accidents reported on a particular highway within a given county. Furthermore, state highways within a county will be assigned section letters, the section length depending upon physical characteristics such as road intersections, corporation limits, etc. Section letters, indicating certain sections of highway, have been assigned numerical codes and this information is also included on the punch card.

Traffic flow in hundreds of vehicles per day is also coded on each punch card and give some indication as to the relative accident exposure of adjoining sections of highway or with other sections of equal length throughout the state. These traffic flow data are used extensively by the Bureau to

establish accident rates for individual sections of highway as well as for the entire system, in terms of millions of vehicle miles. Since information is available on the entire state highway system as to the number of miles of each highway surface type, classified according to width and traffic density, it is entirely possible to compute accident rates for pavement types as well as pavement widths.

Summaries of 1939 accidents reported on state highways outside municipalities, revealed the fact that almost one-third of all accidents were concentrated on 4.5 per cent of the state highway mileage, and this same 4.5 per cent, or 730 miles, accounted for only 14 per cent of the total annual travel.

This illustrates how effectively punch card data can be used to develop long range engineering programs of widening, relocation or future construction. Likewise, many other special accident summaries could be developed from information included on the punch cards which otherwise might be prohibitive unless mechanical tabulation were available.

ENGINEERING CENSUS

NOW that the 1939 National Traffic Safety Contest is history, what does a summarization of the results offer the Traffic Engineer?

Not only has the contest provided figures on traffic engineering performance, but it also has made available separate data on cities in each of the first five population groups.

A number of observations based on a study of the contest reports should be of genuine interest and value. For example, most large cities have a traffic engineer, contest reports show. In fact, this was the case in all but one of the cities of 500,000 or more population. In Group II (250,000 to 500,000 population), traffic engineers are employed by 65% of the reporting cities.

There was a marked increase in the number of traffic engineers employed by Group III cities (100,000 to 250,000 population). Thirty-six per cent of the reporting cities had a traffic engineer in 1939, as compared to only 18 per cent in 1938.

This same trend was found in Group IV cities (50,000 to 100,000 population), where more than twice as many had traffic engineers in 1939 as in 1938.

The National Safety Council recommends that each city of more than 100,000 population obtain the services of a full-time traffic engineer. In cities below 50,000 some member of the city engineering department, or possibly a consultant, should be responsible for this work. In cities between 50,000 and 100,000 population local conditions determine which is most feasible.

Most of the traffic engineers were reported as being in an engineering department or in the department of public safety. In only 18 per cent were engineers reported as a part of the police department. In 1938, the total was 21 per cent. The trend is definitely toward placing the traffic engineer in a position coordinately equal, rather than subordinate, to the police department.

The number of men working regularly in traffic engineering in the different cities was calculated on the basis of equivalent full-time men, since some of the men in many cities work on traffic engineering only part time.

Results for Group 1 show that half of the cities had the equivalent of more than 1.5 full-time men per

RECOMMENDED TRAFFIC ENGINEERING PROGRAMS

CITY I—75,000 POPULATION

Organization—A traffic engineer or responsibility placed on city engineer or other engineering official.

An equivalent of 1.1 full-time men working regularly on traffic engineering.

Investigations Made	Man-Days
Accident Studies	60
Traffic Studies	150
Checking Designs	10
Total	229

Maintenance of signs, signals, and pavement markings — 750 man-days.

Pavement markings maintained — 26.2 miles.

Average yearly expenditures for signs, signals, pavement markings and new street lighting—$11,000.

Substantial program of street improvements.

100% of signs and signals conform to Uniform standards.

CITY II—175,000 POPULATION

Organization—Full-time traffic engineer in an engineering department or department of public safety. An equivalent of 2.6 full-time men working regularly on traffic engineering.

Investigations Made	Man-Days
Accident Studies	140
Traffic Studies	350
Checking Designs	44
Total	534

Maintenance of signs, signals, and pavement markings — 1750 man-days.

Pavement markings maintained — 61 miles.

Average yearly expenditures for signs, signals, pavement markings and new street lighting—$26,000.

Substantial program of street improvements.

100% of signs and signals conform to Uniform standards.

100,000 population working in traffic engineering. Thirty per cent of the cities in this group reported the equivalent of more than 2.7 full-time men per 100,000 population.

A special comparison was made for cities of 100,000 or more population that reported no traffic engineers. Cities without traffic engineers were weak in making accident studies, including collision and condition diagrams and view obstruction surveys.

If a city expects to keep its high accident location well under control, it should spend at least 0.8 man-days per 1,000 population every year, making such accident studies.

Similarly, cities without traffic engineers were weak from the standpoint of man-days spent in checking designs and plans of street improvements for capacity and safety. The study shows that a quarter of a man-day per 1,000 population should be devoted to this important traffic engineering activity in the average city.

Man-days devoted to the maintenance of signs, signals and pavement markings were reported for the first time this year. In every one of the five groups of cities the value exceeded by 30 per cent of the cities was above 10.0 man-days per 1,000 population.

One hundred per cent uniformity of traffic signals was reported by about 50 per cent of the cities. Fewer cities are completely standard from the standpoint of traffic signs.

How does your city rank as compared with the recommended traffic engineering programs? By checking your records, you can identify weaknesses in your traffic engineering program.

Condensed from an article in PUBLIC SAFETY, June 1940. pp. 14, 15.

3 PURPOSE CHANNELIZATION—3 WAY SAFETY DESIGN

by VIRDEN A. RITTGERS

ROMANA PLAZA, a notorious traffic maze of San Antonio, Texas, is a strainer for 50,000 vehicles or 100,000 people every 24 hours. Five of the eight roadways entering it are major traffic arteries connecting the large north and northwest residential areas of the city with the central business district a few blocks to the south.

The control system for the Plaza from the standpoint of the traffic officials had reached the ultimate in simplicity. There wasn't any. The Police Department had tried various plans of officer control, from one man to a whole squad. They tried laning the area with paint lines, and using signs. Everything failed.

Drivers traversing this uncontrolled area from northwest to southeast or vice versa might choose (or be forced to take) any path over a roadway width of 70 to 80 feet. During the heaviest traffic periods tie-ups were frequent and many vehicles were shunted or "blocked" far out of position.

Thus a two-part traffic-control plan of signaling and channelization was indicated as the only immediate solution. The channelization plan adopted had three primary functions. The first function was to bring traffic under a degree of control by providing more definite routes, fitting natural and desired movements, and prevent unnecessary and conflicting movements.

First, a triangular island was designed, to separate the large central area into two main roadways, one northwest-southeast for Main, San Pedro and Navarro Streets, and one east-west for Romano and Navarro Streets. The northeast-southwest flow being the heaviest movement through the area, was further channelized about its centerline. A long, 8-foot medial island was placed through the main area, with tapered islands in each approach, across Main Street on the west and across Soledad Street on the east.

The second function of the channelization was to protect and guide pedestrian crossings.

The third function of the channelization was to facilitate signal placement. Standard signal location was used only at the junction of Main and Romana Streets, which was converted into a normal two-street intersection. At other locations, the rule was to install them where they could best be seen. Signals were located over the islands in the center of the heavy northwest-southeast flow. This permitted a definite separation of the pedestrian and vehicular signals at these points, which was considered desirable in reducing the likelihood of confusion. The pedestrian units were placed at each end of the crosswalks, by themselves.

The signals located at the islands in the central portion of the roadway were designed to be set at post height —not supported by posts or pedestals, but suspended by overhead cables and dropped to the desired height by a short spacer. Cable suspension being unsuited for the northwest and southeast corners of the large triangular island, these signals were designed to be suspended to normal post height from long mast-arms which were in turn supported by one long post located in the central portion of the island. This plan, together with the removal of a heavy ornamental streetlight pedestal from the center of the Plaza, left the area substantially clear of obstructions.

Another safety factor in the general plan was provided in the design details

for the islands. White concrete curbs were constructed 18 inches wide for the 7-inch height. Low shrubbery will outline the long medial island and the triangular island to make the islands stand out, to discourage pedestrian jaywalking, and to improve the appearance. The noses of the islands were striped diagonally, and the needed signs, supported on striped 4 x 4-inch wooden posts equipped with red reflectors, were installed on the islands. The wooden posts give "bulk" for visibility, yet do not constitute a serious obstruction to a vehicle even in an emergency.

It was decided after some study to control the 18 signal heads and 35 signal faces for the Plaza area by one central controller. The numerous movements of vehicles and pedestrians involved, together with the varying clearance distances, called for several odd amber periods and several small lags and leads in addition to the general three-phase cycle. The result was a 16-interval timer with 45 color circuits. Program-type timing was employed in order to keep the cycle length at a minimum for the varying flow of traffic throughout the day. In order further to economize on cycle time, a means was required for lengthening only the desired interval or intervals without lengthening all intervals proportionately.

Construction of the channelizing system is complete, and installation of the signal equipment began in May. Drivers adapted themselves to the new layout with little difficulty even before the laning and marking was complete.

Condensed from an article by Virden A. Rittgers, City Traffic Engineer, San Antonio, Texas, (Assoc. I.T.E.) AMERICAN CITY, June 1940; pp. 103, 105.

THE VANISHING AMERICAN

by LESLIE J. SORENSON

KILLED—12,300!

Injured—260,000!

Statistics from the European War? No—the record of pedestrian casualties in the United States from traffic accidents for 1939.

Truly, unless we find a way to cut this peacetime toll, the pedestrian appears doomed to become the next Vanishing American.

After many years of effective education, it would appear that we have solved only part of the problem, that we must begin also to teach people how to walk.

The pedestrian is still attempting to compete with the automobile for the use of a section of the roadway, much in the same fashion he did in the horse and buggy days. The younger generation is fast learning the hazards of modern traffic conditions but the older people refuse to change a long fixed habit.

The records prove this. Of the 260,000 pedestrians injured last year, 102,000 were in the age group between 25 and 64 years. Fifty-eight hundred of the 12,300 pedestrians killed in 1939 were in this age group.

It is safe to say that if some modern miracle could remove all conflict between the man afoot and vehicle, the urban traffic accident toll would be reduced by 66 per cent in one year.

Statistics and unusually informative data have been collected from all sections of the country — metropolitan centers, smaller cities and rural areas of different types. The nature and severity of pedestrian accidents have been recorded under varying conditions. This accident experience has been divided into age and nationality groups and into classifications of economic and social status.

The committee's 1939 report gave specific facts about pedestrian acci-

dents. It discussed the engineering phase of the problem, outlined selective public and child educational programs and stressed the necessity for traffic law enforcement. Examples of accident prevention were detailed and illustrated.

The 1940 program of the committee and of the Council's headquarters staff assigned to the committee is in the field of promotion and experimentation.

Materials have been provided for authorities who are undertaking a pedestrian program. An interesting experiment in rural pedestrian education has been launched. The Council has just produced a rural pedestrian safety leaflet, entitled "Are Your Feet Killing You?" This leaflet outlines rural traffic hazards, shows how to correct them and lists safe walking practices.

It is heartening to learn of pedestrian safety campaigns initiated in many cities. Safety messages have been placed on bread wrappers in Worcester, Mass., and on milk bottles in Salt Lake City. Public address cars for pedestrian education have been used in Kansas City, Mo.; New Rochelle, N. Y.; Evansville, Ind.; Sacramento, Calif.; Lincoln, Nebraska; Monroe, Mich.; Portsmouth, O.; Evanston, Ill.; Beatrice, Neb.; and Washington, D. C. These are but a few examples taken at random from a long list of cities which reported such activity to the National Safety Council.

The pedestrian deserves the same attention as the motorist and the Council's committee will continue to develop and promote programs for the control and protection of the Vanishing American.

Condensed from an article by Leslie J. Sorenson, Traffic Engineer, Chicago, Ill. (Mem. I.T.E.) PUBLIC SAFETY, June 1940, pp. 16, 17.

TURNPIKE SIGNS TO BE LATEST IN SCIENTIFIC RESEARCH

by ROBERT S. HOLMES

WITH contractors on the Pennsylvania Turnpike making use of all kinds of "firsts" in road building equipment and methods, final details, which will prepare the new super-road for a steady stream of motor traffic, are rapidly getting under way. Newest development in scientific traffic research are the directional and regulatory signs which will line the highway from Harrisburg to Pittsburgh, keeping highspeed traffic moving at an efficient rate and providing the utmost in safety for the motorist.

Considering the cost of traffic signs in relation to that of the gigantic superhighway itself, it might be casually observed that their size, legibility, and position are of little importance to the road user. On the contrary, advanced students of highway research have found in the signing of a highway a valuable study in accident reduction and ease of travel.

Initially the engineers knew that present standard signs as used by state highway departments everywhere were inadequate to meet the needs of the Turnpike. High speeds, tunnel and interchange approaches, and ticket booths necessitate special warnings to motorists. There was no information available to indicate the correct sizes for practical application. Because of these factors, the opportunity was welcomed to join with the Yale Bureau in a study of sign legibility.*

Tests on pure legibility were conducted for letter heights from six to twenty-four inches using two differ-

*Paper presented before Highway Research Board at the 19th Annual Meeting, December 5-8, 1939, on "Legibility of Highway Destination Signs" by Dr. T. W. Forbes, Yale Bureau for Street Traffic Research, and R. S. Holmes, Pennsylvania Turnpike Commission.

ent letter widths. A total of about 400 people acted as observers making approximately 4600 individual observations. In this manner, results were obtained showing maximum and minimum legibility distances in relation to height and width of letter, reflectorization and illumination. If the results are applied to give the motorist ten seconds warning at a speed of 50 miles per hour, it is foreseen that *at least* a ten-inch Series A (wide) or a 12-inch Series B (narrow) letter would be needed for night conditions.

Before the details of final design were evolved, a thorough investigation and testing of various types of materials and reflecting mediums was undertaken to determine the most modern practices and uses in existing sign construction. Emphasis was placed on night visibility since studies had shown it to be highly important that all reflectorized signs facing high-speed traffic should begin to attract the motorist's attention at distances of 2000 feet or more. It is essential that the motorist be given full and ample warning of a change in alignment or the approach to a tunnel or interchange, particularly at night when the visibility is restricted to the range of the headlight beam. For this reason practically all of the sign designs were based on the legibility distance best suited for night driving. Since visibility distances were taken from the results of the research tests, the proper letter sizes were automatically determined. In turn the letter size was the chief factor in regulating the over-all sign dimensions so that the logical sequence of design elements contributed to the finished product.

The interchanges being an important feature of the Turnpike, the motorist will receive his first indication of his approach to these facilities at a point two miles in advance. The information will be repeated at one mile and again at one-half-mile from the interchange; that is, before the cloverleaf layout itself can be seen in the distance.

The tunnels demand advance warning chiefly because of the transition from two-lane traffic to one lane in each direction, as well as the reduced speed required for safe movement through them. Therefore warning is first given one mile in advance of the tunnel portal and again at the half-mile point, followed by other regulatory signs indicating the speed and change in pavement width.

Next in importance to the signing of interchanges and tunnels is the placing of curve warning signs. Although there are no curves exceeding six degrees (radius 955 feet), it was decided to sign all of the curves of one or more degrees of curvature by varying the angle and size of the curve symbol. These will range from an arrow bent at a 30-degree angle on a 24-inch sign to an arrow bent at 90 degrees on a 48-inch sign. All of the curve symbol signs will be placed at a uniform distance in advance of each curve and will be visible at distances ranging from 2000 feet to one-half mile.

Leading highway and traffic authorities have agreed that proper, scientific signing is highly important to the efficient functioning of any road. No single element in the design and construction of the 160-mile Pennsylvania Turnpike will receive so much public attention, as well as criticism and praise from the motorists, as will the signs which guide and direct them safely and speedily over the new road.

Condensed from an article by Robert S. Holmes, Traffic Division, National Conservation Bureau (formerly with the Pennsylvania Turnpike Commission). HIGHWAY BUILDERS, May 1940; pp. 13, 14, 15.

Attention Members!!

THE ELEVENTH ANNUAL CONVENTION INSTITUTE OF TRAFFIC ENGINEERS

Chicago, Illinois - October 5-8, 1940

STEVENS HOTEL

Arrangements have been made with the Stevens Hotel to have all of the members of the Institute and their wives lodged on one floor. In order to carry out effectively this plan and secure our share of low rate rooms as well as the best floor in the Hotel, it is necessary for us to get our reservations *in early*. Please send your reservations to:

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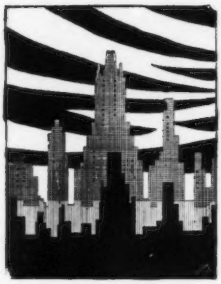

Traffic Engineering NEWS

Mention Your Institute Affiliation

Don't forget to use your Institute affiliation when writing a paper or giving a talk. Every month some of our members are writing articles for national magazines or giving talks before important meetings. Frequently they fail to mention their affiliation with the Institute when giving their official title, department or organization. To help them and to help the Institute, it is felt that more attention should be brought to their Institute membership.

Knoxville Courses

Traffic officials and the motoring public will be glad to learn that engineers are increasing their efforts to make streets and highways safe. Under present operating conditions the roadway must be so designed and controlled as to compensate for natural errors. This can be brought about through signs, signals, markings, channelization and geometric design. Outstanding examples of Traffic Engineering have reduced accidents from 40% to 75%.

Many public officials charged with traffic control are unable to attend the graduate courses of the Bureau and to fulfill their request for training, the Bureau has given since 1935 an intensive two week's course. This will be given this year for the third time as a part of the National Institute for Traffic Safety Training, to be held this year at Knoxville, Tennessee, from August 12 to 24th.

This Traffic Engineering Training School will be given by the four senior members of the Bureau staff, Miller McClintock, Director; Maxwell Halsey, Associate Director; and Theodore Forbes and Theodore Matson, Research Associates. In addition, Mr. Howard Menhinick, Acting Chief, Land Planning Division, Tennessee Valley Authority, and Mr. Grant Mickle, Traffic and Safety Engineer, Michigan State Highway Department, will serve as guest lecturers.

The one hundred and thirty-six alumni who have graduated from this course state that a great deal of value is obtained from the discussions which take place among traffic experts from many parts of the country.

Traffic subjects which are of day by day practical use to Traffic Engineers are covered. These are as follows:

1. Surveys and Research
   (a) Volume (b) Speed
   (c) Origin & Destination
2. Accident Analysis

3. Mechanical Control
   (a) Signs (c) Markings
   (b) Signals (d) Islands
4. Traffic Planning
5. Organization
6. Administration
7. Public Relations
8. Intersection Design
9. Human Factors

Special subjects of geographical importance are discussed in evening meetings. Each year the subjects have changed sufficiently to warrant students coming back for consecutive years.

Each student is required to bring with him at least one serious local problem, together with the essential traffic information. These will be worked out in class.

Last year sixty men attended. A number of applications for this year's course have already been received.

Junior Traffic Engineer Wanted

Mr. E. M. Powell, Secretary and Chief Examiner of the Civil Service Board of Dallas, Texas, announces an examination on July 2 for Junior Engineer, assigned to traffic.

The requirements for this position are: graduation from a recognized engineering school; plus two years' experience, preferably either some experience in traffic, or road or street work. The salary range on this classification is $160-$200; the starting salary has not definitely been set.

The Junior Traffic Engineer will become an assistant to Mr. Walter Klapproth, (Mem. I.T.E.), recently selected through competitive examination for the position of city traffic engineer of Dallas.

The written part of the examination will not be an assembled examination except for those in the immediate vicinity of Dallas. For those applicants outside this vicinity, the examination papers will be sent to someone in their own city and will be administered there.

Anyone interested in this position may write to Mr. E. W. Powell, Secretary and Chief Examiner, Civil Service Board, City Hall, Dallas, Texas.

Resolve To Do Your Share

The National Safety Council is again conducting an intensive campaign to hold down the heavy toll of accidents during the Independence Day celebration and the month of July. The Institute has pledged its cooperation in this program and urges its members to assist in every possible way.

In July 1939, 8,770 people lost their lives in traffic accidents. If the rising trend of deaths in the current year continues an even more serious condition is to be anticipated but—this can be prevented if everyone cooperates to a common end.

The Institute will welcome information from its members of local activities, with which traffic engineers are cooperating. Please let us know what you are doing and what it accomplishes.

The Show Must Go On!

Ambitious authors are urged to submit manuscripts for 5-minute skits to be used in the Resolutions Committee Show at the Annual Convention in Chicago. No prizes, no glory, but here's your chance to get even with *everybody!* The Committee will not undertake to defend authors against libel suits or mayhem. Send your skits to Headquarters by August 15.

Activities of Members

Mr. Louis E. Bender (Assoc. I.T.E.) recently graduated from the Yale Bureau for Street Traffic Research, has returned to the Indiana State Highway Commission as Assistant Traffic Engineer.

Otto K. Jelinek, traffic engineer of the Chicago Park District (Member I.T.E.) has been re-elected charman of the directors of the traffic engineering and city planning section of the Western Society of Engineers.

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Standard signals adapted for all types of mounting. Synchronous and induction control mechanisms and accessory devices.

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6″ LETTERS

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Reflector Delineation gives essential road information after dark at daylight distances. The alignment and driving limits of the road are outlined by a channel of light.

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Special Street Lighting Committee

Mr. Howard F. Ilgner, Superintendent and Chief Engineer, Bureau of Electrical Service, Milwaukee, Wisconsin, and Chairman of the Special Street Lighting Committee of the Institute, submitted a progress report to the Board of Direction at its mid-year meeting in Chicago, May 1, that deserves special mention. The Special Street Lighting Committee is a joint committee with the Street and Highway Lighting Committee of the Illuminating Engineering Society. The purpose of the joint committee is to report present traffic volume data pertaining to various cities as a basis for street classification and to offer suggestions and comments based on individual community traffic volume. The report submitted to the Board by Mr. Ilgner was in its final stages.

The Special Street Lighting Committee had planned to give its findings and conclusions to the I.E.S. at its meeting in Cleveland, May 15, 16, and 17. Mr. Ilgner planned to be present to personally represent the Institute and present the Special Street Lighting Committee report.

Directional Signs

The New Jersey State Highway Department is experimenting with a new form of illumination for directional signs. The illumination is produced by two 20-watt fluorescent tubular lights which according to reports provide a better color of light, diffuse the light much better, and cost only half as much to operate as the old style lights. Those old style lights averaged about $45 per year for electrical current, patrolling and replacing burnt-out lamps.

Until recently the New Jersey State Highway Department used directionary and cautionary signs lighted by two 100-cp. incandescent lamps. They were housed in a metal box painted on the inside with a white reflecting paint. The front of the box was covered with two separate glass panels, one of double-flashed opal glass with lettering sandblasted into the glass and then painted with a heavy black paint. A front glass embedded with wire mesh served as a shield for the lettered glass. The opal glass diffused light to a certain extent, but "hot spots" could not be prevented. The new fluorescent lamps apparently take care of all the difficulties encountered with the incandescent lamps.

New Jersey is also trying out a transparent plastic plate to cover the front of the box, with letters sandblasted into it and painted as before. The original cost of the plastic front plate will be about half the cost of the present wire and flashed opal-glass panels. If the experiment is successful, wire glass will not be required as a shield, and the breakage and handling costs will be reduced.

Traffic Engineering Fellowships

The Yale Bureau for Street Traffic Research announces that nineteen Fellowships are available for the academic year 1940-1941. The Fellowships will be of two groups. The Alfred P. Sloan State Highway Traffic Engineering Fellowships, of which there are seven, are available only to employees of State Highway Departments. The Bureau for Street Traffic Research Traffic Engineering Fellowship, of which there are twelve, are available to employees of organizations having authority over, or responsibility for, the engineering phases of traffic control, and to graduate students seeking a career in traffic engineering.

Anyone wishing further information about these Fellowships may write to: Maxwell N. Halsey, Associate Director, Bureau for Street Traffic Research, Yale University, New Haven, Connecticut.

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